

REMARKS

Prior to entry of the present Amendment, claims 1-14 were pending in the present application. Claim 2 is cancelled above. No new matter is added by the claim amendments.

Claims 1-14 are rejected under 35 U.S.C. 112, second paragraph. The Office Action states that it is not clear what is required by the recitation of "only" in claims 1 and 12. The language "only" is removed from claims 1 and 12. Reconsideration of the rejection of claims 1-14 under 35 U.S.C. 112, second paragraph, is requested.

Claims 1, 2, 8, 9, 11 and 12 are rejected under 35 U.S.C. 102(b) as being anticipated by JP 63-271938. Claims 5-7 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP 63-271938. Claims 1-14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Delehanty, *et al.* (U.S. Patent No. 5,780,363) in view of JP 63-271938. In view of the amendments to the claims and the following remarks, the rejections are respectfully traversed, and reconsideration of the rejections is requested.

In the present invention as claimed in claims 1-11, a method of cleaning a substrate includes applying an aqueous sulfuric acid solution diluted by deionized water onto the substrate having at least one of a metal wiring and a metal film formed thereon and cleaning contaminants existing on the substrate in accordance with a reaction between the diluted aqueous sulfuric acid solution with the contaminants by applying a mega-sonic energy to the substrate with the applied diluted aqueous sulfuric acid solution while reducing damage to the substrate and preventing corrosion of the at least one of the metal wiring and the metal film.

Claims 1-11 are amended to clarify that the method includes cleaning contaminants existing on the substrate in accordance with the reaction between the diluted aqueous sulfuric acid solution with the contaminants by applying a mega-sonic energy to the substrate including the applied diluted aqueous sulfuric acid solution while reducing damage to the substrate and preventing corrosion of the at least one of the metal wiring or the metal film. It is believed that these amendments to the claims clarify the distinctions between the claimed invention and the cited references.

In the present invention as claimed in claims 12-14, a method of cleaning a substrate includes providing an aqueous sulfuric acid solution diluted by deionized water in a bath, immersing the substrate having at least one of a metal wiring and a metal film into the diluted aqueous sulfuric acid solution and cleaning contaminants existing on the substrate in accordance with a reaction between the diluted aqueous sulfuric acid solution and the contaminants by applying a mega-sonic energy to the substrate including the diluted aqueous sulfuric acid solution while reducing damage to the substrate and preventing corrosion of the at least one of the metal wiring and the metal film.

Claims 12-14 are amended to clarify that the method includes cleaning contaminants existing on the substrate in accordance with a reaction between the diluted aqueous sulfuric acid solution and the contaminants by applying a mega-sonic energy to the substrate including the diluted aqueous sulfuric acid solution while reducing damage to the substrate and preventing corrosion of the at least one of the metal wiring and the metal film. It is believed that these amendments to the claims clarify the distinctions between the claimed invention and the cited references.

A substrate may be impaired due to a mega-sonic energy applied during cleaning a substrate. In particular, when a metal pattern is formed on the substrate, the metal pattern may be seriously corroded during cleaning the substrate. In the present invention, the substrate is cleaned using an aqueous sulfuric acid solution diluted in deionized water and applying the mega-sonic energy to the substrate, thus reducing damage to the substrate and preventing corrosion of a metal wiring or metal film on the substrate.

JP 63-271938 discloses a workpiece such as a substrate subjected to a cleaning treatment after an ultraviolet radiation treatment. The cleaning treatment includes immersing the substrate in one vessel of concentrated sulfuric acid having a concentration of 98%, then immersing the substrate in one vessel of pure water, and immersing the substrate in a isopropyl alcohol (IPA).

JP 63-271938 fails to teach or suggest a method of cleaning a substrate having at least one of a metal wiring and a metal film that includes cleaning contaminants existing on the substrate in accordance with a reaction between the diluted aqueous sulfuric acid solution and the contaminants by applying a mega-sonic energy to the substrate including

the diluted aqueous sulfuric acid solution while reducing a damage to the substrate and preventing a corrosion of the at least one of the metal wiring and the metal film, as claimed in claims 1-11 and 12-14. Instead in JP 63-271938, when the substrate having the metal wiring or metal film is cleaned using the concentrated sulfuric acid having the concentration of 98%, the metal wiring or the metal film may be seriously corroded by the concentrated sulfuric acid. While in the present invention as claimed in claims 1-11 and 12-14, damage to a substrate is reduced and corrosion of a metal wiring or a metal film is prevented because the substrate is cleaned using an aqueous sulfuric acid solution diluted by deionized water and applying a mega-sonic energy to the substrate. JP 63-271938 in no way teaches or suggests this feature.

JP 63-271938 fails to teach or suggest certain elements of the invention set forth in claims 1-11 and 12-14. Specifically, JP 63-271938 fails to teach or suggest that a method of cleaning a substrate having at least one of a metal wiring and a metal film that includes cleaning contaminants existing on the substrate in accordance with a reaction between the diluted aqueous sulfuric acid solution and the contaminants by applying a mega-sonic energy to the substrate including the diluted aqueous sulfuric acid solution while reducing a damage to the substrate and preventing a corrosion of the at least one of the metal wiring and the metal film, as claimed in claims 1-11 and 12-14. Therefore, it is believed that the claims are allowable over the cited reference, and reconsideration of the rejections of claims 1, 2, 8, 9, 11 and 12 under 35 U.S.C. 102(b) as being anticipated by JP 63-271938 and of claims 5-7 and 10 as being unpatentable under 35 U.S.C. 103(a) over JP 63-271938 is respectfully requested.

Delehanty, *et al.* discloses removing polymer residue using a solution of sulfuric acid, hydrogen peroxide and water.

Delehanty, *et al.* fails to teach or suggest a method of cleaning a substrate having at least one of a metal wiring and a metal film that includes cleaning contaminants existing on the substrate in accordance with a reaction between the diluted aqueous sulfuric acid solution and the contaminants by applying a mega-sonic energy to the substrate including the diluted aqueous sulfuric acid solution while reducing a damage to the substrate and preventing a corrosion of the at least one of the metal wiring and the

metal film, as claimed in claims 1-11 and 12-14. Instead, in Delehanty, *et al.*, there is no teaching or suggestion of applying a mega-sonic energy to a substrate during a cleaning process, and, therefore, does not reduce the damage caused by the mega-sonic energy to the substrate. There is no teaching or suggestion in Delehanty, *et al.* of reducing damage to the substrate.

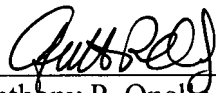
Hence, neither of Delehanty, *et al.* and JP 63-271938, as discussed above, teaches or suggests certain elements of the present invention set forth in amended claims 1-11 and 12-14. Specifically, neither of the references teaches or suggests a method of cleaning a substrate having at least one of a metal wiring and a metal film that includes cleaning contaminants existing on the substrate in accordance with a reaction between the diluted aqueous sulfuric acid solution and the contaminants by applying a mega-sonic energy to the substrate including the diluted aqueous sulfuric acid solution while reducing a damage to the substrate and preventing a corrosion of the at least one of the metal wiring and the metal film, as claimed in claims 1-11 and 12-14. Accordingly, there is no combination of the references which would provide such teaching or suggestion. Neither of Delehanty, *et al.* and JP 63-271938, taken alone or in combination, teaches or suggests the invention set forth in the claims. Therefore, it is believed that the claims are allowable over the cited references, and reconsideration of the rejections of claims 1-14 under 35 U.S.C. 103(a) based on Delehanty, *et al.* and JP 63-271938 is respectfully requested.

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In view of the amendments to the claims and the foregoing remarks, it is believed that all claims pending in the application are in condition for allowance, and such allowance is respectfully solicited. If a telephone conference will expedite prosecution of the application, the Examiner is invited to telephone the undersigned.

Respectfully submitted,

Date: July 18, 2007
Mills & Onello, LLP
Eleven Beacon Street, Suite 605
Boston, MA 02108
Telephone: (617) 994-4900
Facsimile: (617) 742-7774
J:\SAM\0532\amendmentc.doc



Anthony P. Onello, Jr.
Registration Number 38,572
Attorney for Applicants